

## The Relationship between Umbilical Cord Arterial PH and Short Term Outcome in Neonates

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### Abstract

**Background:** Perinatal asphyxia has been one of the causes of neonatal morbidity and mortality. Morbidity and mortality in asphyxia depends on factors like duration and severity of asphyxia. The present study was carried out to find out the relationship between umbilical cord arterial blood pH with severity of birth asphyxia and short-term outcome in the neonates.

**Materials and Methods:** hospital based prospective study carried out at NICU of tertiary care hospital attached to medical college in southern Rajasthan from January 2020 to December 2021. All term neonates born by Caesarean Section (C/S) to a high risk mother were included into the study. An umbilical cord arterial blood gas analysis was done for these neonates. All the neonates with congenital anomalies and those who were not willing to give consent were excluded. All the admitted newborns were followed till discharge/death for final outcome. The correlation umbilical arterial cord blood pH and outcome was analysed statistically.

**Result:** During the course of the study, 78 babies who included for the study. Out of the 78 babies, 77 babies were discharged live and one baby died. On the basis cord blood ph level, the babies were divided into two groups. Among whom 34 had pH less than 7.25 (group 1) and 44 had pH more than 7.25 (group 2). Comparison of short term outcomes between two groups were as the following: need for resuscitation 9 vs. 1 (P = 0.004), NICU admission 8 vs. 2 (P = 0.012), convulsion 2 vs. 1 (P = 0.41), encephalopathy 3 vs. 1 (P = 0.19), delay to start oral feeding 5 vs. 1 (P = 0.04).

**Conclusion:** An umbilical cord arterial ph of less than 7.25 could be associated with unfavourable short term outcome in neonates with perinatal asphyxia.

**Keywords:** Birth asphyxia; Umbilical cord arterial blood pH; Hypoxic ischemic encephalopathy.

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## Background

In recent times, interest to find out the measures to predict adverse neonatal outcome in high risk babies has grown very much. Perinatal asphyxia has been defined as clinical condition occurring due to impaired gas exchange leading to foetal hypoxia & hypercarbia during the labour. It can be identified by foetal acidosis that can be measured by blood gas analysis of blood sample drawn from umbilical artery. Artery umbilical cord blood gas (aUCBG) analysis allows an objective assessment of acid-base status of fetus and also help in determination of well-being of fetus at the time of delivery, and thus this helps in indirectly and directly reflecting the fetal conditions [1,2]. British and American Colleges of Obstetrics and Gynecology recommends use of umbilical artery blood gas analysis in high risk deliveries to predict neonatal outcome [3].

APGAR score at 5 minutes less than 3, pH less than 7.00 and base deficit more than 16mmol/L have been associated with adverse neonatal outcome including adverse neurologic outcome [4] and the same has been proven by studies. APGAR score correlation with neurological outcome has not been consistent and thus as a tool to predict neonatal outcome is not good [5]. Many vigorous neonates which do not require any resuscitation at birth may have low pH and many neonates which seem to be dull and depressed at birth can have normal blood Ph [6,7].

This means that what constitutes clinically significant acidaemia is unclear. The aim of the study was to analyze a large cohort of deliveries, across the entire pH range, to document the relationship between umbilical cord arterial pH and short term outcome in neonates delivered by high risk caesarean sections.

## Materials and Methods

This was an observational hospital based prospective study carried out at NICU of tertiary care hospital attached to medical

college in southern Rajasthan from January 2020 to December 2021. Prior approval was sought from institutional ethical committee of medical college.

All term neonates born by Cesarean Section (C/S) to a high risk mother based on neonatal resuscitation program entered the study [8]. An umbilical cord arterial blood sample was taken according to the AAP protocol. All samples were sent in pre-heparinized syringes and prepared under aseptic condition and occupational safety. The samples were analyzed by ABG analyzer 30 minutes after birth. All the neonates with congenital anomalies and those who were not willing to give consent were excluded. Further treatment was based on standard protocols. Informed consent was obtained from parents. Data including pH, PO<sub>2</sub>, PCO<sub>2</sub>, BE and bicarbonate along with demographic data like maternal risk factor and age, gestational age, weight and sex of neonates were recorded. All babies were followed up until discharge/death and the data was collected as per proforma.

Data were analyzed by SPSS, version 22. X<sup>2</sup> test, Mann-Whitney and Spearman test were used. P less than 0.05 were considered as being significant.

Outcome variables that were recorded in this study are as follows

**Need for resuscitation:** Any form of intervention at birth other than routine care (providing warmth, drying or mopping, positioning, stimulation). These include positive pressure ventilation, endotracheal intubation, chest compressions, intra venous medications (adrenaline).

**Need for NICU admission:** Babies requiring NICU admission as deemed necessary by the attending pediatrician for any reason.

**Delay in attaining full feeds:** Babies who had some form of significant feed intolerance or could not satisfactorily breast feed by day 3 of life.

**Convulsions:** Babies with convulsions – generalized or subtle, from any cause in the newborn period.

**Encephalopathy:** Babies with features suggestive of hypoxic ischemic encephalopathy and classified as per modified Sarnat and Sarnat scoring.

### Results

During the course of the study, there were 78 babies eligible and recruited for the study. Out of the 78 babies, 77 babies were discharged successfully and one baby

died during the course of hospitalization.

On the basis cord blood pH level, the babies were divided into two groups. Among them, 34 had pH less than 7.25 and thus categorized into group 1 and 44 babies had pH more than 7.25 who were categorized into group 2.

The cord blood pH ranged from 6.94 to 7.45, with a median pH of 7.22

Various results that were found during the course of study have been summed up in the tables below:-

**Table 1: Difference between the two groups on basis of variables studied**

Variables (yes/no)	Group 1 (ph<7.25) (n=34)	Group 2 (ph>7.25) (n=44)	P value
Resuscitation required	9	1	0.001
Nicu admission required	8	2	0.012
Convulsions	2	1	0.41
Encephalopathy	3	1	0.19
Delay in attaining feeds	5	1	0.04

**Table 2: Mean pH and Range of pH associated with short term outcomes**

Variable studied	Number of neonates	Mean cord blood pH	Range of cord blood pH	P value
Need of resuscitation	10	7.13	7.01-7.22	0.004
No need of resuscitation	68	7.26	7.16-7.31	
Nicu admission need	10	7.10	7.04-7.17	0.0003
No nicu admission	68	7.27	7.17-7.31	
Convulsions	3	7.10	7.05-7.20	0.419
No convulsions	75	7.25	7.13-7.31	
Encephalopathy	4	7.19	7.00-7.31	0.19
No encephalopathy	74	7.27	7.13-7.31	
Delay in feeding	6*	7.09	7.00-7.13	0.04
No delay in feeding	71	7.25	7.15-7.31	

### Discussion

This study attempted to correlate umbilical cord pH in high risk newborns with early neonatal outcome as measured by variables like Need for resuscitation, NICU admission, Delay in attaining full feeds, Convulsions and Encephalopathy.

The whole study group was divided into 2 groups. Group 1 with babies having cord blood pH less than 7.25 and consisted of 34 newborns. Group 2 included babies with pH >7.25, consisted of 44 babies.

In our study, Resuscitation requirement was more frequent in newborns of group 1 with a p value of 0.001 which was statistically significant. The study by Ahmadpour-kacho M et al [9] on 120 high risk neonates reached to the conclusion that neonates with pH 7.2 had more frequent resuscitation need. They concluded that pH of 7.2 can be taken as a cut off for determining the prognosis of short term outcome in neonates

In our study, 10 babies required NICU admission of which 8 (23%) belonged to group1 and 2(4.5%) from group2. A p value of 0.012 was obtained which was statistically significant. A similar observation was noted in the study by Ahmadpour-kacho M et al [9] which was statistically significant. Victory et.al[10] found that the risk for NICU admission progresses with worsening of acedemia at birth in term neonates.

In our study, 6 babies who had delay in attaining full feeds. Among these, 5 babies (14.7%) belonged to group 1. The 1 baby (2.2%) in group 2 died before even the feed could be commenced. Statistically significant P value of 0.04 was obtained. Mousa Ahmedpour et al [9,10] also correlated pH with delay in starting feeds.

In this study, there were 3 babies with convulsions and 4 babies with encephalopathy. 3 babies (8.8%) with HIE and 2 babies (5.8%) with seizures were under group 1. Though there was a difference in the number of subjects in both the study groups, there was no significance statistically on applying Fisher exact test. Malin GL [11] found that low cord arterial pH was significantly associated with adverse neonatal outcomes. HIE was found to be associated with odds ratio 16.9. Yeh P [12] found that seizure within 24 hours of life was more among neonates with  $pH < 7$ .

In our study it was found that high risk babies who needed resuscitation, nicu admission or had delay in attaining full feeds had a median cord blood pH which was significantly lower than the other babies (p value  $< 0.05$ ). This implies that babies with a low cord blood pH should be carefully monitored during the entire neonatal period. This finding is similar to that in the study done by Mousa Ahmedpour [9].

Thus analysis of cord blood pH in high risk newborns is a reliable parameter in predicting some morbidities and outcome in the early neonatal period.

Due to short period of study and single centre study, number of cases was less, so there is need of further study for better evaluation. Also long term follow up could not be done which could have led to better assessment of neurological outcome in these neonates

### Conclusions

High risk term neonates with cord pH  $< 7.25$  have an increased need for resuscitation, need for NICU admission and delay in attaining full feeds, when compared to those with  $pH > 7.25$ . There is no correlation between cord blood pH and incidence convulsions and encephalopathy in term high risk newborns in this study. In high risk newborns, the median cord blood pH is significantly lower in those who required resuscitation, NICU admission or had delay in attaining full feeds compared to the other babies. And thus measurement of cord blood pH is recommended for all high risk newborns.

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